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War Reserve Materiel Capability Assessment (WRM-CA)

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FOR THE COMMANDER

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13. ABSTRACT *(Maximum 200 words)*

The purpose of the War Reserve Materiel Capability Assessment (WRM-CA) program, sponsored by the Air Force Research Laboratory (AFRL), is to enable the Air Force to track, assign, and greatly increase the visibility of War Reserve Materiel (WRM) around the world. Currently, there is no Air Force system to organize, collect and utilize WRM data in a way that can be advantageous to potential users. The development of the system was based on the integration and analysis of information collected from AFI 25-101, WRM Tiger Team minutes and from users at numerous bases located throughout the Continental United States (CONUS), United States Air Force in Europe (USAFE), and Pacific Air Forces (PACAF), as well as first-hand observation of the WRM processes at those bases. In addition to describing the current process, users identified process problems and improvement ideas for use in the development of WRM-CA. In some cases, the improved system was then presented back to the users for their review and verification to ensure a solid foundation from which to build towards the final demonstration version of WRM-CA. WRM-CA is a decision support tool. The purpose of this tool is to provide decision support to logistics planners with the resulting benefits of reducing the size of deployment packages by locating and assigning WRM to deploying units. Previous experimental versions of WRM-CA were developed to demonstrate to the Air Force that a tool of this nature could assist in the deployment of units in a timelier manner, but those systems had limited functionality. After additional development and enhancement, the WRM-CA software tool is now robust enough to fully demonstrate the capabilities, effectiveness, and benefits to the warfighter.

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EXECUTIVE SUMMARY

Changes in technology and fundamental restructuring and downsizing of the military call for fresh thinking about how the military accomplishes its goals and objectives. The challenge is to adapt and use organizations, processes, and rapidly changing technologies to achieve greater effectiveness and quality at reduced cost. Organizations that master change will continue to improve their operational effectiveness, while those failing to reengineer their practices and policies will gradually loose their competitive edge in our ever-changing world.

The purpose of the War Reserve Materiel Capability Assessment (WRM-CA) program, sponsored by the Air Force Research Laboratory (AFRL), is to enable the Air Force to track, assign, and greatly increase the visibility of War Reserve Materiel (WRM) around the world. Currently, there is no Air Force system to organize, collect and utilize WRM data in a way that can be advantageous to potential users. The systems in place today are ad hoc and tracked with current, commercial off-the-shelf software systems. These off-the-shelf systems have limited functionality. Research into the subject of post cold war WRM has identified the need for additional capabilities. WRM-CA provides the war fighter with planning and visibility capabilities that far out perform any other system in place.

The development of the system was based on the integration and analysis of information collected from AFI 25-101, WRM Tiger Team minutes and from users at numerous bases located throughout the Continental United States (CONUS), United States Air Force in Europe (USAFE), and Pacific Air Forces (PACAF), as well as first-hand observation of the WRM processes at those bases. In addition to describing the current process, users identified process problems and improvement ideas for use in the development of WRM-CA. In some cases, the improved system was then presented back to the users for their review and verification to ensure a solid foundation from which to build towards the final demonstration version of WRM-CA.

While the basic WRM process will remain relatively constant into the future, the technologies available to implement the process will change dramatically. With the year 2010 selected as the first implementation target, the focus of the Year 2010 Concept of Operations (CONOPs) is to implement these current or anticipated technologies. As time progresses beyond 2010, evolving

technologies will replace the Year 2010 technologies as appropriate, further enhancing the effectiveness of the WRM process. These enhancements in WRM use will minimize the deployment footprint, reduce the reaction time required to satisfy a deployment tasking, and finally utilize the millions of dollars of WRM assets not being put into use today during contingency operations.

The intended goal is to have an Air Force wide system that will interface with other pertinent Air Force legacy systems that will give the user current WRM information and allow users to manipulate that data when required and authorized. Ultimately, when WRM-CA is used in the way it is intended, it will support the operation by not only reducing the deployment footprint, but also deploying organizations will trust the serviceability of the WRM assets and deployed commanders will be able to plan for the use of WRM in their operations. Thus, the possibility exists that Air Force tactical operations in the area of responsibility could begin sooner than they could before.

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1. INTRODUCTION

The lack of visibility and the inability to assign WRM assets positioned around the world has limited the value and benefit of the millions of dollars invested in the Air Force WRM program. Unit Deployment Managers (UDMs) do not have insight to the status of the WRM resources, unit commanders do not have faith in the assignment process, and Major Command (MAJCOM) WRM managers lack the necessary tools to assign the resources on a unit priority basis. Accordingly, there is a need for a decision support tool to provide visibility of WRM resources and enable efficient assignment of those resources to deploying units.

WRM-CA is a decision support tool developed by Synergy, Inc. under contract with AFRL. The purpose of this tool is to provide decision support to logistics planners with the resulting benefits of reducing the size of deployment packages by locating and assigning WRM to deploying units. Previous experimental versions of WRM-CA were developed to demonstrate to the Air Force that a tool of this nature could assist in the deployment of units in a timelier manner, but those systems had no substance to their functionality. Finally, after a long development and research contract, the software can now demonstrate the capabilities necessary to prove its effectiveness and potential benefit to war fighters and logisticians.

The tool will allow users to select sites from a map and view the exact details of the WRM at each site. The user can view the National Stock Number (NSN), condition, serviceability, status, maintenance record and other detailed information of each WRM item. Once a deployment plan is loaded, it will be shown on the map. Details of each unit's needs are displayed. Users can see what WRM is available, and then assign it to deploying units. WRM shortfalls are displayed if the necessary items are unavailable or out of service. Using this information, a unit can reduce its footprint by minimizing overlap of materials. Since the material is already on location or in the theater of operations, there is no need for the deploying unit to take up valuable transportation assets with the same items. In this manner, units will know exactly what WRM will be onsite waiting for them, and what they will need to bring.

WRM-CA will increase effectiveness of deployment plans by reducing the amount of material units need to take with them. Unit leaders will be confident in the status of WRM at the receiving site because they can see that it is there in good condition and assigned to them. WRM

assignment will no longer be a function of the haphazardness first-come-first-served policy that currently governs WRM use. WRM will be used effectively and accurately with the use of this tool.

2. PROBLEM ANALYSIS

2.1 Problem Statement

Ever since the beginnings of the Cold War between the United States (US) and the then Soviet Union, the United States Air Force (USAF) has been prepositioning wartime equipment all over the world for use in contingency operations. Eventually to become known as War Reserve Materiel, these assets were originally going to get the North Atlantic Treaty Organization (NATO) and US forces started earlier in the defense of Western Europe and parts of Asia. This equipment was Operations Plan (OPlan) driven; which meant it was positioned at numerous locations to a level commensurate to the level of wartime activity occurring at that base or region. Millions of pieces of equipment comprised these stocks.

Early in the 1990s, the Soviet Union ceased to exist, taking with it the threat of worldwide domination of a communist regimen. Until this time, the Air Force WRM program was well maintained. Equipment was serviceable and trustworthy. After this time, though, stocks all over the world became less and less of a priority since, at that time, the need for quick, world wide deployments had diminished.

By the end of the 1990s, the Air Force WRM program was in need of improvements. Funding for repair and replacement was shrinking and not many war planners even understood that WRM existed. With these issues at hand, the WRM Tiger Team in October 1999 included the following statement in its report to the Air Force WRM Executive Review Board:

"The AF WRM program does not have the flexibility to support both deliberate and crisis action planning and execution." With that in mind, AFRL and Synergy, Inc. developed an even more detailed problem statement that exposed the real core of the problem:

"Due to lack of visibility and effective use of serviceable WRM and prepositioned assets located around the world, millions of dollars in Air Force funds are spent in the purchase,

positioning, and maintenance of assets not used in the execution of contingency operations."

From these two statements, the AF came to the realization that an all encompassing WRM visibility, assignment and management tool was needed. The funding wasted year after year on unused equipment was becoming staggering. Also, with the advent of the Air Expeditionary Force (AEF) concept, and the speed required to get wartime operations started, the Air Force would need serviceable and dependable WRM assets for contingency use.

2.2 WRM-CA Theory

The theory behind WRM-CA was straightforward: by developing an automated system that could display Total Asset Visibility (TAV), provide a capability to assist base level WRM managers in the management of WRM stocks, provide a capability to track the assigned use of WRM assets and present a capability assessment of WRM inventories within a WRM Unit Type Code (UTC), we could better utilize the existing worldwide WRM stocks and greatly reduce home station deployment timelines and logistics footprints.

It was clear what the technical prerequisites were for the visibility, management, and assignment process capabilities. The capability assessment function was going to be more involved to produce due to its dependency on other Air Force legacy computer systems. With those issues in mind, the development of the Air Force's first WRM management tool began.

2.3 Defining User Requirements

Throughout the research into the WRM issue, Synergy contractors found many of the personnel addressed more than willing to provide input into the system development. The frustration was evident at the lack of attention the worldwide WRM program receives as well as the wasted potential of the program. It was with these thoughts in mind that Synergy personnel initiated information gathering interviews with potential WRM-CA users.

The first information gathering trip took Synergy personnel to Ramstein AB, Germany where they met with the head of the USAFE WRM program, Major Kirsten. The main issues of concern were inventory levels at the WRM warehouse in Sonem, Luxemburg. An inventory

tracking system as well as a better way to track the maintenance histories of the equipment were required. The Microsoft Excel spreadsheets used for inventory tracking were working, but the majority of time in Germany, provided no capability to see real time information on the equipment under his charge. Also, due to the magnitude of the storage facility, a way to track and review inventory changes and maintenance record updates was also required. After five days in Germany and Luxemburg, the WRM-CA team came home with good ideas on where to start development.

The next data collection trip took the WRM-CA team to the Republic of South Korea. The bases visited were Taegu and Kimhae. Personnel from units that had a stake in the WRM process were interviewed and asked several questions. The subject matter of the questions ranged from describing the WRM process as you know it to where they felt the issues lay in the WRM process. Some major themes that were repeated were the support they received or did not receive from headquarters in the way of funding, personnel and technology that could help them do their job better. The technology subject was the target which Synergy personnel expanded upon. Synergy found that WRM equipment visibility, assignment tracking and up-to-date equipment tracking was lacking. The units in Korea felt if an automated tool could be developed that could alleviate some, if not all, of those issues; it would be well worth the money to create. Upon their return from Korea, the WRM-CA team expanded more on the visibility and assignment process.

Before the next data collection trip, a quality first proof of concept "draft" of WRM-CA was developed. It included many of the features the users required plus a few more. This version of WRM-CA became a player in the Joint Expeditionary Force Experiment (JEFX) 2000 beginning in May 2000. JEFX 2000 included various operating locations where base and MAJCOM level users had ample opportunity to test and discuss the WRM-CA system. Represented during JEFX were Aviano AB, Italy; Barksdale AFB, LA; Davis Monthan AFB, AZ; and Air Force Staff personnel located at the Pentagon. While exercising WRM-CA during JEFX 2000, all the players from the before mentioned bases had the chance to use and test WRM-CA. Use of the system generated feedback and determination of system requirements. Changes required to the system were then made during the course of the exercise. Information vital to the development

of WRM-CA was collected during JEFX 2000. Much of the data was input into the system to help improve its functionality.

Although the WRM-CA team did not get a chance to speak to more potential users of the system than they desired, the information gathered as well as the background of client and system programmers was believed to provide a quality proof of concept system that could be developed and begin to alleviate many of the WRM issues existing today. Once the interviews were completed and the information compiled, it was not long before intense WRM-CA development occurred.

2.4 Risks

As with any software development program, there were risks that needed to be taken into consideration. Overall, the primary issues were broken into two parts: program risks and technical risks.

2.4.1 Program Risks

One of the biggest issues addressed was the level of effort necessary to accomplish system development. Since the scope of the development contract was to develop the proof of concept software, concentration on just one or two small areas of development was not desired. In depth research was needed in order to identify requirements from potential users. This breadth vs. depth balance was challenging at times. Also, when Synergy applied for and were accepted to participate in JEFX 2000, they knew valuable development time was going to be taken up while participating at various JEFX experiment locations. The aggressive scope and schedule of JEFX posed a possible threat to Synergy's software development.

2.4.2 Technical Risks

Of any of the risks the WRM-CA team had, technical risks were probably the most prevalent. There were various areas within technical arenas that needed attention.

2.4.2.1 System Interfaces

When coming up with the ideas for system development, Synergy knew in order for WRM-CA to fully function, it needed to access information from other Air Force legacy systems. The

ability to obtain interface agreements, access to the system itself to gain information required and system classification issues all weighed heavily on whether or not system development would be successful.

2.4.2.2 Data Issues

Another technical risk encountered was with data issues between Air Force legacy systems and the WRM-CA development environment. The quality, timeliness and consistency of data between the legacy systems and WRM-CA as well as the existence of common data elements with the Air Force systems were major concerns. The latter of the two was the most important to quality integration. If the data elements did not match, it would be tough to make WRM-CA work.

2.4.2.3 Security Challenges

Due to some of the subject matter (i.e., classified OPlans) WRM-CA would access, it was obvious WRM-CA would need to operate in a secure environment. The challenge to develop a system that could be transitioned to a classified environment yet be tested in an unclassified environment. Developers wanted to make sure they did not compromise any classified information.

2.5 Risk Mitigation

After the risks were identified an acceptable approach to mitigate those risks needed to be identified. The following sections outline the risk mitigation procedures.

2.5.1 Program Risk Mitigation

The WRM-CA team decided to concentrate on a breadth vs. depth balance that would allow developers to touch on many areas of system operation, but not get extremely deep into development of all of those areas with the exception of a few. Once again, realizing they were developing a proof of concept system, and not a system to be fielded at the end of the contract assisted programmers in deciding what areas to concentrate detailed development efforts. The areas developers would concentrate serious programming on where the areas identified by potential WRM-CA users as "must haves."

When JEFX 2000 started, Synergy realized much of the time spent on trips to satisfy JEFX management requirements might interrupt software development. The aggressive scope and schedule of JEFX 2000 may also prevent Synergy from developing the software to the level intended, but this was not the case.

Synergy programmers were not only able to develop the software to the level required, but also keep in pace with the JEFX 2000 schedule. The result was a quality, proof of concept system that JEFX 2000 participants were satisfied with.

2.5.2 Technical Risk Mitigation

Once again, the contract required the development of a proof of concept system that investigated the possibilities of using new technologies to render the system functional. Realizing that this area was the least defined of all, an agreement on "how far was far enough" on system interfaces, data issues and security challenges was established.

2.5.2.1 System Interface Risk Mitigation

The work around for this area was to investigate whether or not developers would be able to get access to the systems in the first place. If they could not, then they would request data base schemes that would at least allow programmers to set up an "exercise" database that could be used for development purposes. If those attempts failed, the final technical report deliverable would annotate the results of the system interface efforts, as appropriate.

2.5.2.2 Data Issue Risk Mitigation

This area of risk mitigation was approached in very much the same way as the system interfaces. Data from Air Force legacy systems that would work in the WRM-CA system needed to be obtained. Any issues with data collection and consistency would be addressed in the final technical report for WRM-CA and suggested solutions identified.

2.5.2.3 Security Challenge Risk Mitigation

To help alleviate this issue, it was decided no classified information would be used in its development until it was absolutely necessary. That meant the interface with the Joint Operations Planning and Execution System (JOPES) would have to wait until near the end of the

contract for final development. Also, the inclusion of other classified information such as the Wartime Aircraft Activity Report (WAAR) would have to wait until further development could be done. Appropriate analysis and requirements objectives would be achieved if development were done in an unclassified environment.

3. SOFTWARE DEVELOPMENT

3.1 Development Process

A spiral development process was followed which was composed of the following steps:

3.1.1 Define user Requirements

The WRM-CA development team spent many hours discussing this subject with several individuals who would have a stake in the WRM process. These personnel included wing WRM Officers and unit WRM monitors. As stated before, team members traveled to Korea and Europe to discuss the process and find out from users what they would want in a system. Several hours were also spent discussing WRM issues with AFRL personnel, some of which had logistics planning and WRM management background. AFRL also assisted us greatly in ideas for use of the system. The overall plan was to visit several operational bases and discuss issues with the WRM managers, but due to scheduling conflicts, only a select few bases were visited. The WRM-CA team obtained quality information from the bases visited. With that in mind, Synergy felt they received enough information to develop a proof of concept system acceptable to AFRL.

3.1.2 Analysis

After Synergy further broke down the user requirements provided to us by WRM stakeholders, they had to analyze from the data collected what functions were the most needed in the system. From the data collected and various scenarios developed, use cases were created to build the system around. From the scenarios and stakeholder interviews, it was concluded worldwide asset visibility, WRM assignment tracking, and awareness of asset condition were the most important functions required in the program. In addition, a quality search engine and map navigation, were included in development efforts. The narratives and use cases are identified in Appendix A and B respectively.

3.1.3 System and Architecture Design

The system architecture and application were refined and developed. They developed it as a client/server application so it could prove that such an application could work for the Air Force WRM program. Eventually, developers want to "webify" the system so users can use it in an internet environment.

3.1.4 System Testing

After useable software was developed, the developers would test the system. They would go though each area of the software to correct any issues and then continue development in areas that as required. This iterative approach to software development was key to the quality of the final product. By developing, releasing, then testing, programmers were able to find and fix software issues as well as continue spiral development. This approach to testing was very effective and efficient. It allowed design issues to be kept at a minimum and obtain valuable, constructive feedback from the client and other users. This approach ensured developers were meeting and, in some cases, exceeding customer requirements and objectives.

3.2 System Architecture

WRM-CA was developed using a distributed component architecture based on a J2EE (enterprise environment) and Enterprise Java Beans. Developers did this for three main reasons:

Scalability – The system architecture can grow as system needs grow. It will be simple to add other clients and servers to the architecture since it was developed to sustain that type of progression.

Industry Standard – Since the Java programming language is now a strong industry standard for software development, Synergy wanted to ensure they were using current techniques. A J2EE architecture reduces the reliance on a single vendor's product.

Reusability – The architecture and programming language can be used with other Java applications with no need to convert programming code into other forms.

The database tables used to show the database relationships for the system architecture are at Appendix C and a diagram of the high-level system architecture is at Appendix D.

3.3 Interface Development with Legacy Systems

In order for WRM-CA to work properly, data interfaces from other Air Force computer systems were required. Candidates for data requirements included the Standard Base Supply System (SBSS), Core Automated Maintenance System (CAMS), Logistics Feasibility Analysis Capability (LOGFAC), On Line Vehicle Information Management System (OLVIMS) and JOPES. Access to these systems was necessary in order to automatically update the WRM-CA server and clients with correct maintenance, supply, transportation and inventory information. The following sub-sections provide a description of each system, analysis efforts and each system's role within WRM-CA.

3.3.1 SBSS

WRM-CA developers wanted to gain access to the SBSS server so they could filter and identify more clearly which equipment was considered WRM. SBSS designates these assets as such by using a code system. WRM-CA would filter out all assets that did not have the code of either "C" or "D." A "C" coded item is considered joint use WRM, meaning it can be used in peacetime for the normal operations of the base, but once a contingency occurs requiring WRM use, it is called back to the owning unit and put into pure WRM status. Many times, vehicles fall into this category. A "D" coded item is considered pure WRM. These assets are over and above the normal operating stock of a base and are to be used only when needed for contingency or war. Many base assets can fall into this category.

After further research it was determined an interface to SBSS was not required. The same information plus more of what was required could be obtained from LOGFAC, which will be discussed later. Although it was decided not to interface with SBSS, no technical obstacles are present that would prevent the system from interfacing with WRM-CA, should it ever be required.

3.3.2 OLVIMS

OLVIMS tracks the inventory and maintenance records of all vehicle assets at an Air Force location. WRM-CA would require an interface with OLVIMS to display accurate WRM vehicle records. Even though other systems provide inventory data, they lacked specific vehicle inventory and information required.

An interface with OLVIMS was never established. The OLVIMS system office had many other issues that had a much higher priority than WRM-CA; therefore no extensive interface work with OLVIMS occurred. Developers were able to ascertain from the information provided that an interface with OLVIMS was possible with no obvious technical issues present to prevent it.

3.3.3 JOPES

The JOPES system is the primary operations plan (Oplan) forces tracking tool used by the Air Force and other military services. It contains all unit type code (UTC) data for deployable Air Force assets. Users of JOPES assign these assets, via UTC, to a war plan, which is then tasked and executed as required. An interface with the JOPES system would allow WRM-CA to obtain vital OPlan information that would be pertinent to the WRM asset assignment process. Since JOPES contains the needed plan information, a working interface with JOPES was a priority. There were no serious technical issues with setting up an interface with the JOPES system. Synergy programmers worked on the interface and had it briefly working during JEFX 2000. When the interface occurred, both WRM-CA and JOPES were on the secure SECRET Internet Protocol Router Network (SIPRNET). There was no chance of secure information being compromised.

There were no significant interface development issues that would preclude Synergy from refining and further developing this interface. The primary issue was the WRM-CA development environment. Since WRM-CA development was done in an unclassified environment, consistent interaction with JOPES could not occur; therefore, developers of WRM-CA established and outlined the process for the construction of the JOPES interface so system connection could occur quickly when required.

3.3.4 CAMS

An interface to CAMS would provide WRM-CA with up-to-date maintenance records for the WRM assets at a given base (mainly flight line type WRM). With this information in hand, users would have even more information available to make educated decisions on the use of WRM equipment.

Issues with CAMS involved the inability to set up an interface due to the way its architecture is configured. CAMS was developed in a programming language much older than current languages, therefore, it was extremely difficult to create interface framework. For example, WRM-CA developers would have no way to query the system to get any information without developing a totally separate computer program that it could apply to CAMS so system access could occur. Synergy did not have the time or the manpower to take on such a task. One of the functional managers did suggest programmers develop a "screen scrape" type interface. A screen scrape would take the data fields from CAMS and import it into WRM-CA. That would only provide limited information and not the critical information required. Also, the CAMS office was very busy with developing and establishing a new system that corrects the issues just discussed, therefore, time for WRM-CA developers to get guidance and information from this office was not workable.

3.3.5 LOGFAC

LOGFAC is the "WRM System," which means it contains a vast majority of the Air Forces' WRM information. The information obtained from an interface with LOGFAC would negate some interfaces with other systems. LOGFAC stores information on WRM assets on the base in question, therefore eliminating the interface requirement for SBSS. As WRM-CA continues to develop, additional WRM information LOGFAC stores such as the wartime consumable distribution objective and the wartime aircraft activity report will be required for proper system operation.

Currently, WRM-CA developers have received the import process data for LOGFAC, which is pertinent to establishing a system interface. No major programming hurdles exist with developing an interface with WRM-CA.

3.4 System Functionality

Once the interfaces are programmed and developed, WRM-CA will have the capability to meet a majority of the user needs. The main area Synergy could not meet, due to system design, was obtaining the asset maintenance information from CAMS. WRM-CA has the capability to display the information once obtained, but additional development time and funding will be required. Other than that issue, the system can perform all user needs. The following sections

will outline and discuss the most important user requirements and how WRM-CA meets the need.

3.4.1 Worldwide WRM Visibility

This functionality will give the user, should they have the appropriate system access, the exact location of any WRM equipment in the world. The user can either search by location using the map function or they can search by asset nomenclature/NSN by using the asset search function. This visibility option is also expanded by displaying Points of Contact (POCs) for WRM assets at the location in question as well as displaying the asset's deployment and unit assignment history.

3.4.2 WRM Asset Assignment

WRM-CA will also display and show, interactively, at all locations the assignment of WRM assets for contingency or peacetime use. Users will have the real-time ability to distinguish what equipment goes where during planning phases. This will lead the way in reducing the deployment footprint as well as put millions of dollars of WRM equipment to use.

3.4.3 WRM Asset Condition

Since no interface with an equipment maintenance system can be established, WRM asset condition will be the responsibility of the base WRM monitor. WRM-CA could be modified to accept user updates. If this is the case, then WRM asset condition would be visible and increase user confidence in the assets would be established. Not until WRM-CA was developed has there been a system that has the capability to display real time maintenance information for WRM assets. In the past, the unit WRM monitor tracked asset condition. WRM monitors were also not always provided reliable information in a timely manner. With the advent of WRM-CA, situations such as this would end, providing WRM monitors more accurate and quality asset information.

3.4.4 Automated Information Technologies (AITs)

Currently, web phone capabilities are resident in WRM-CA by allowing users to either deny or approve user requests for WRM remotely (away from their computer) by using a cell phone to

contact the WRM-CA server. This capability will increase coordination and communication while decreasing the wait time for asset approval or denial.

Additional functionality includes asset accountability for WRM, where an interface with a Radio Frequency (RF) program will allow WRM-CA to pickup RF tags and display the inventory status of all WRM assets at a location.

3.4.5 Other Functionality

WRM-CA will also have the capability to display multimedia pictures of WRM so users have an idea of the physical condition of the asset.

WRM-CA can generate reports for selected sites that will provide both summarized and specific WRM information.

Security measures are put in place that will control what users can see and do with the WRM assets. Users will also be able to collaborate real time with other users to help improve communication and asset control.

4. OTHER OPTIONS

Throughout the analysis and development of WRM-CA, Synergy came across several topics and areas where they wanted to put more emphasis, but did not for one reason or another. The following sections outline these areas.

4.1 Lessons Learned

Although the interface with the CAMS system did not materialize, several positive elements came out of that situation. Due to the current vision the Air Force has adopted, the emphasis on Agile Combat Support has been increased and more attention has been placed on information technology and data accuracy than before. WRM-CA provides its users with that information and data accuracy by interfacing or providing the capability to interface with several pertinent Air Force information systems. In regards to the issue with the CAMS system, the Air Force has once again realized the importance of accurate and useful data. They understand if they want to pursue the WRM-CA technology, more emphasis must be placed on the data acquisition from

older Air Force systems so the information can be useful to newer systems. As stated before, no major hurdles, with the exception of CAMS, exist in the system interface area. Future cooperation between the Air Forces' system program offices and WRM-CA personnel will ensure successful WRM-CA integration.

Synergy had also wanted to try and design the system as more of a web tool than a client server system. Although that was not part of the Statement of Work (SOW), they realized the Air Force is heading toward World Wide Web (WWW) functionality. Understanding of this concept is one of the reasons Synergy designed the system using Java technology. Therefore, when the time comes, the WRM-CA team will have somewhat of a smooth transition to webification. Also, the Oracle database design used, the work towards DII-COE system compliance and the inclusion of WRM-CA on other webified applications demonstrates the desire to assist the Air Force with a webified WRM-CA.

Synergy had also hoped to secure and finalize the interface between WRM-CA and the current version of Unit Type Code – Development and Tailoring (UTC-DT). To do that, they would have required a Common Object Request Broker Architecture (CORBA) interface so WRM-CA's Java application could speak to UTC-DT's Delphi application. An interface between WRM-CA and future versions of UTC-DT is a smart idea. It will essentially make two tailoring tools into one and allow for quicker and more accurate deployment equipment packages. With UTC-DT providing the "80% solution" after its initial run, the WRM-CA system will further assist war planners in tailoring deployment packages. By having this capability, the Air Force will find it will make the 48-hour bombs on target limit and substantially diminish its logistic footprint from home station.

4.2 Additional AIT Capability

Numerous areas in this arena need to be pursued further. The concept of "smart" buttons that have enough memory to hold information on maintenance and deployment history intrigued the WRM-CA team as well as many laser identification tag readers. These technologies could be used to better track WRM-CA asset information in lieu of other systems that may not be of benefit.

After a visit to Headquarters (HQ) Air Force Materiel Command (AFMC), Synergy had all kinds of ideas to investigate. They decided to go with the web phone and RF tag inventory systems since we felt they could make a greater impact on the development and usability of the system.

The options for AIT application to this system seem to be endless. In addition to the buttons and RF tag systems mentioned above, there are bar codes storing maintenance information that can be read by hand held devices with laser scanners. These scanners can then transfer updated information to desktop computer systems via radio frequency. This type of system can increase the productivity of maintainers and decrease delays in acquiring updated maintenance information. The relevance of these systems to the future of the Air Force is obvious. By making it easier for personnel to perform their duties, the mission of the Air Force will be executed more efficiently and more effectively by increasing deployment processing speed and data accuracy. With this approach in place, the Air Force will continue to be unstoppable in the future.

4.3 More Uses of WRM-CA

Currently, WRM-CA is a one-dimensional system. Aerospace Ground Equipment (AGE) was strategically used to develop the system so it could prove the concept that an application of this type could work.

4.3.1 More Equipment

WRM-CA should be populated with all WRM equipment and information (i.e., war consumable distribution objectives and wartime aircraft activity reports). This would include, but not limited to, generators from civil engineering, trucks and other vehicles from transportation, as well as pallets and nets from all base units. It also could be used to track the maintenance histories of the equipment as well as where it has been in the past. WRM-CA has the capability to truly have complete worldwide visibility of all WRM assets.

4.3.2 Munitions and Other Consumables

WRM-CA could also provide visibility to WRM munitions inventories as well as other consumables such as petroleum products and Meals Ready to Eat (MRE).

Showing visibility to WRM munitions could assist planners in creating realistic munitions use scenarios with the exact numbers available and then have a concrete plan to present to unit commanders on sortie rates and munitions use.

Also, having visibility to the other consumables on site can better prepare deploying forces by establishing if, in the case of available rations, more MREs are required.

5. SUMMARY

The concept of centralized WRM control and visibility has come a long way since the inception of the WRM-CA contract in September 1999. During that time, primary issues important to the Air Force WRM program were ascertained. By providing a way for WRM mangers to see where and how much WRM was available and that it would be set aside for their unit to use when deployed, were key contributors to demonstrating the value and stand requirement for the system.

Overall, WRM-CA has merit and should be developed further. The equipment maintenance information interface needs to be implemented as well as the other system interface requirements. Further discussion of the WRM information contained in the system needs to be addressed as well as future enhancements to the AIT systems. Also, once webified and fully operational, the system will be a tool desperately needed by warfighters today and in the future.

With the inclusion of only a small percentage of the WRM categories in the Air Force represented, the system proved itself over and over with its functionality and potential. Once fully developed and its full potential realized, WRM-CA will be a powerful weapon in the technological arsenal of the United States Air Force.

GLOSSARY OF TERMS AND ABBREVIATIONS

AEF	Air Expeditionary Force
AFMC	Air Force Materiel Command
AFRL	Air Force Research Laboratory
AGE	Aerospace Ground Equipment
AIT	Automated Information Technology
CAMS	Core Automated Maintenance System
CONOP	Concept of Operation
CONUS	Continental United States
CORBA	Common Object Request Broker Architecture
HQ	Headquarters
IDO	Installation Deployment Officer
JEFX	Joint Expeditionary Force Experiment
JOPES	Joint Operation Planning and Execution System
LOGFAC	Logistics Feasibility/Analysis Capability
LOX	Liquid Oxygen
MAJCOM	Major Command
MRE	Meals Ready to Eat
NATO	North Atlantic Treaty Organization
NSN	National Stock Number
OLVIMS	On Line Vehicle Information Management System
OPlan	Operation Plan
PACAF	Pacific Air Forces
POC	Point of Contact
POL	Petroleum, Oils, and Lubricants
RDD	Required Delivery Date
RF	Radio Frequency
SBSS	Standard Base Supply System
SIPRNET	SECRET Internet Protocol Router Network
SOW	Statement of Work

TAV	Total Asset Visibility
UDM	Unit Deployment Manager
ULN	Unit Line Number
US	United States
USAF	United States Air Force
USAFE	United States Air Force in Europe
UTC	Unit Type Code
UTC-DT	Unit Type Code-Development and Tailoring
WAAR	Wartime Aircraft Activity Report
WRM	War Reserve Materiel
WRM-CA	War Reserve Materiel Capability Assessment
WWW	World Wide Web

APPENDIX A

Narratives

Narrative 1--Squadron user browses sites in theater looking for useable equipment

The 391FS from Mt Home AFB has been tasked to deploy 12 F-15E's to Aviano AB in support of a NATO exercise. The Installation Deployment Officer (IDO) in the 366FW is looking for support equipment in theater to reduce the airlift required and decrease the force closure time for the squadron.

The IDO signs into WRM-CA and selects the Aviano AB from the map. From the popup menu, the IDO selects "search for WRM items." The search dialog is displayed and the IDO restricts the search to a 900KM radius around Aviano, and enters the date range for which they will be needed.

The IDO initially wants to find Liquid Oxygen (LOX) carts compatible with the airframes from the 391st, and enters the NSN normally used for their UTCs. After clicking "find," the system displays a list of items with that NSN which are unallocated for that date range. The list only includes three carts, two from the warehouse in Sonem, Luxembourg, and one stored at Aviano itself.

Knowing that some of the carts designed for other airframes may work, the IDO selects "Find alternate NSNs" from the dialog and is presented with another dialog that allows searching based on partial NSNs or nomenclature. Entering "LOX" for the nomenclature search, and clicks "Find." The system displays a list of 25 matching NSNs, the nomenclature for each, and a checkbox already checked to indicate the system has selected these for the next level of search. The IDO unchecks several items that are obviously wrong, verifies the date range is what was entered earlier, and clicks "Find Items."

The system displays a larger list of various LOX carts stored in several locations. Of the locations, Sonem has the most carts, three dozen carts; 15 of nsn1, 11 of an nsn2, and 10 of an nsn3. The IDO selects one of the "nsn1" items from the list and then clicks "View Item" to get more information. The system then displays a screen with summary information about the item, links to multimedia, maintenance history, deployment and reconstitution history.

The IDO selects "Save As HTML" and stores the report in a local file. Returning to the list of items displayed in the previous step, the IDO proceeds to the same for two other items as well. The IDO then composes an e-mail message to the Petroleum, Oils, and Lubricants (POL) flight chief, attaching the saved files, asking if any of these LOX carts will work with the airframes deploying.

Narrative 2--Squadron user requests use of items

The IDO from the 366FW receives a reply from the POL flight chief stating that because of their unique requirements, they could only use one of the three different kinds of LOX carts the IDO found earlier.

The IDO signs into WRM-CA and selects "Request Items" and the system responds with the Select Plan/ULN screen (items usually are requested or allocated against a particular ULN within a plan). The IDO selects the plan for the NATO exercise, and the system displays a list of ULNs within the plan. The IDO selects the ULN for the 391st FS and clicks "Open." The system then displays the "Find Items" screen.

The IDO selects "Sonem" from the site list, selects the NSN ("nsn1") of the appropriate LOX cart from the NSN list, verifies that the date range displayed (pulled from the plan/ULN information) is correct, and clicks "Find Unallocated." The system displays a summary list of items with NSN "nsn1" at Sonem.

There are now only 12 carts available (down from 15 earlier), and the list shows that another unit within the same plan has requested 8 of those 12. The list also shows that the last maintenance performed on 2 of the unrequested 4 carts was before the last deployment date.

The IDO selects these 2 items, and selects "Notify" from the popup menu. The "Item Notify Options" screen is displayed, the IDO marks the "Maintenance History" checkbox, marks the send e-mail checkbox (e-mail addresses are stored in the user profiles), and clicks "Notify."

The system returns to the summary list of items, and the IDO then marks the request checkbox for all 4 carts, as well as 2 of the carts already requested by another unit, and clicks "Request items."

Narrative 3--Owning MAJCOM WRMO works through list of requests

The owning MAJCOM WRMO from USAFE knows there are multiple requests for items stored at the Sonem warehouse and so signs into WRM-CA and selects "Sonem" from the map. From a popup menu, the WRMO selects "Review Requests" and the system responds with the Select Plan/ULN screen (items usually are requested or allocated against a particular ULN within a plan).

The WRMO selects the plan for the NATO exercise, and the system displays a list of ULNs within the plan. The WRMO does not select any ULN (wanting to see all of them), in the list of requests to view checks "Outstanding," "Partially Approved," "Approved," leaves "Denied" unchecked, and clicks "Open." The system then displays a summary of all items from Sonem requested by a ULN in the plan. After sorting and summarizing the list by NSN by ULN, the WRMO sees that one particular item (LOX carts) has multiple requests for the same items, and the total requests for that particular NSN exceed the number on hand as well.

The WRMO is just coming up to speed on the planning for the NATO exercise, selects "Organize Collaborative Session" to send a message to all the parties involved to discuss the competing requests. The system presents a screen with multiple options to invite people to participate. The system defaults to all users with outstanding requests at Sonem, so the owning WRMO only has to add the Using MAJCOM WRMO to the list and click "Invite." The system then displays a collaboration session planning screen which prompts for basic information such as proposed date and time (23 Feb, 1800Z), brief description, and contact information. After filling in the appropriate information, the WRMO clicks "OK" and the system then sends messages to all invited users (WRM-CA messages that will be displayed the next time the user logs in as well as regular e-mail messages.)

The system returns to the summary list, and the owning WRMO sees several individual requests that can be dealt with directly. One request was for an inviolate asset, so the WRMO selected the item and clicked "Deny Request" from the menu. The system prompted for a reason, and after clicking "OK" the request was marked as denied, the screen and database were updated, and a message was sent to the user and the using MAJCOM WRMO.

The owning WRMO selected the request for two light carts, and clicked "View Details" from the menu. After the system displayed more information on the two items requested, the WRMO selects them both and clicks "Approve Request" from the menu. The using MAJCOM WRMO had not yet processed the request (both the owning MAJCOM and using MAJCOM must approve the request), so the system sent a message to the unit and the using MAJCOM WRMO.)

Narrative 4--Using MAJCOM WRMO works through messages and requests

Using MAJCOM WRMO for the 50th FS (HQ ACC/LGXW) receives an e-mail from the owning MAJCOM WRMO (USAFE/LGXW) letting him know that the USAFE has approved a request by the 20th FW on the squadron's behalf for the use of two light carts to be transported from Sonem to a base in Hungary. The ACC/LGXW WRMO signs into WRM-CA and the system displays a message screen letting him know there are new messages to be processed.

The WRMO clicks "Process Messages" and the system displays a list of requests from ACC units. By default it shows all requests: partially approved, approved, denied, and outstanding. The WRMO selects the message from USAFE for the 50th FS request and clicks "View Request." The system displays the request screen showing a status of "partially approved" since both USAFE and ACC must approve the request.

ACC has two units currently deployed to the same base, one of which was returning to home station. Both of the deployed units were currently using WRM light carts, so he clicks "Deny Request" from the menu. The system prompted for a reason, and after clicking "OK" the request was marked as denied, the screen and database were updated, and a message was sent to the user and the owning MAJCOM WRMO.

Narrative 5--Owning MAJCOM WRMO initiates collaboration session

At approximately 1700Z, 23 Feb (an hour before the scheduled time for a collaborative session), the USAFE/LGXW WRMO (owning MAJCOM) receives an e-mail from the system reminding him to login and setup the session. A few minutes later, the WRMO signs into WRM-CA and the system displays a message screen letting him know he has a collaboration session scheduled for 1800Z, and the WRMO clicks "Setup Session" to initiate the session.

The system displays the "Collaborative Session Setup" screen which shows the list of invited users, description and other information. The WRMO remembers an e-mail message from the maintenance supervisor in the 86MMS at Sembach AB about delays in repairing the LOX carts in the warehouse. He decides to include the supervisor in the session, and clicks "Invite Other Users."

By default the system only displays the users currently logged in, and the maintenance supervisor is not in the list. The WRMO unchecks "Currently logged in users only," selects the "86MMS" from the units list, and clicks "Refresh display." The system now shows all valid

users in the 86MMS, and the WRMO selects the maintenance supervisor and clicks "Invite Now." The system notes that the user is not currently logged in, sends an e-mail message to the supervisor requesting his participation, and then returns to the "Collaborative Session Setup" screen.

The WRMO clicks "Start Session" and the system displays a screen with the current session information, currently connected users, and a chat box. The only user displayed at this point is the USAFE/LGXW WRMO.

Narrative 6--Squadron user joins a collaborative session

At approximately 1700Z, 23 Feb (an hour before the scheduled time for a collaborative session), the 366FW IDO receives an e-mail from the system reminding him a collaborative session for WRM-CA is scheduled for 1800Z. The IDO remembers discussing this with the POL flight chief, so he fires off an e-mail to the flight chief and the UDM for the 391st FS letting them know he is participating in a collaborative session to discuss the LOX carts.

Just before 1800Z, the IDO signs into WRM-CA and the system displays a message screen letting him know the collaboration session scheduled for 1800Z has been established, and the IDO clicks "Join Session" to join the session. The system displays a screen with the current session information, currently connected users, and a chat box. The current users shown are the USAFE/LGXW WRMO (listed as session lead), the ACC/LGLW WRMO, and some IDOs and UDMs from other units.

Narrative 7--UTC-DT user requests use of items

The 389th FS at Mountain Home AFB has been tasked, short notice, to deploy to Kunsan AB, ROK. They are to send a 10-ship F-16 package with all required support equipment. The IDO, knowing the 389th has 6-ship, 12-ship and 18-ship deployment packages, boots up UTC-DT.

While using UTC-DT, the IDO enters all the parameters needed for the deployment including location number of aircraft deploying and the time of year of the deployment. He runs the program and after about 5 minutes, is given a first cut equipment list for the deployment.

As usual, he notices there is a lot of AGE equipment designated for deployment, namely bomb loaders, NF-2 light carts, and -86 generators. He decides he will check the WRM at and near the deployment location to see if the 389th can borrow some of it.

He clicks the proper drop down menu and selects Kunsan AFB and any other base within 200 miles. He sees at Kunsan there are several pieces of WRM available, but much of it is not the AGE equipment he is looking for. He sees there is 1 bomb loader and 2 -86s available for use. He checks the status of all the pieces and sees, through the WRM-CA multi media that the pieces look well worn. He checks the MX records of the equipment and confirms what he suspected. All pieces are down for maintenance (a hose here and a tire there). He wonders what the MX Super would have to say about the MX issues. He checks to see who is currently on-line, notes that she is, and sends her a message through the system and tells her to take a look at what is there and whether or not the pieces are fixable.

In the meantime, the IDO decides to check the other locations for more usable WRM. He notices Suwon has much of the AGE ground equipment they need, and in good shape. He puts in a request for use of 5 NF-2 light carts to help supplement the airfield lighting, 5 -86 generators, and 8 bomb loaders. If granted, this request would completely take care of the requirements for those equipment pieces.

After about 10 minutes, he gets a message from the MX Super. She informs the IDO that none of that equipment is usable. It is all hard broke. The IDO responds back that it will not pose a problem due to the request he made. He asks her to share the request with her UDM to get inputs. He then passes on the requests and information to the 389th UDM for his inputs.

About 10 minutes later, both UDMs call back and say they like what he has done and to let them know when everything is allocated to them.

After a few more minutes, the IDO receives a message from HQ ACC/LGXW that the equipment pieces have indeed been allocated to them and they could leave home station equipment behind. The IDO notifies the using units on base and then goes back into UTC-DT and sees that with the approval entered into WRM-CA has automatically tailored out those items from his UTC.

Narrative 8--Additional squadron user joins collaborative session

The UDM from the 391st FS received e-mail about their requests for LOX carts from Sonem, and the collaborative session beginning at 1800Z. Shortly after the session was started, the UDM signs into WRM-CA. Since the UDM had not specifically been invited to join the session, he clicked "Show current sessions" from the "Collaboration" menu. The system responded with a list of current sessions that were marked as "public," which included a brief description and an "open/closed" status.

The UDM selected the session described as "Discuss conflicting requests for use of WRM from Sonem in NATO exercise" (listed as open), and clicked "Join Session." The system displays a screen with the current session information, currently connected users, and a chat box. The current users shown are the USAFE/LGXW WRMO (listed as session lead), the ACC/LGLW WRMO, the 366FW IDO, and some IDOs and UDMs from other units.

Narrative 9--Owning MAJCOM WRMO uses collaborative session to make allocation decision

The session leader (in this case the owning MAJCOM, USAFE/LGXW) facilitates the discussion on who really needs how many items and where, how quickly out of service items will be repaired, and how the equipment should be allocated. During the session, the participants will send group or individual messages via the chat screen, lookup related information on their own (maintenance information, multimedia, past deployment history), and modify their own requests or approvals.

At some point during the session the participant with the authority do so (usually the session leader, but not necessarily so) may make a final determination as to the allocation including any combination of approvals and denials, subject to other required approvals. (See narrative 10,

"Owning MAJCOM allocates equipment"). They may decide instead to postpone the decision until another collaborative session or just make the decision independently.

All of the changes to the information will be disseminated to the other participants so everyone is working with the same information. The modified information may be posted or abandoned by the session leader at the close of the session.

Some collaboration session features

- Chat session always available
- Individual users may quit the session, if the session leader quits, the session will end
- Individual users may join sessions in progress subject to the normal public/private, open/closed rules
- Main display to resolve conflicting requests sorted by site/NSN/item/requesting ULN
- Two groups of columns, initial and current zzzz
    - Requested quantity
    - Status (partially approved, approved, denied, outstanding)
    - Allocation quantity (only for partially approved or approved)
- Same rules for modifying information applies during collaborative session
    - Using units and MAJCOMs who initiated the request may change the requested amount (current info column)
    - Using and owning MAJCOMs may change their approval (add or remove approval, add or remove denial)
    - Owning MAJCOM may change allocation quantity

Narrative 10--Owning MAJCOM WRMO allocates equipment among requesting units

The owning MAJCOM WRMO (USAFE LGXW) views the list of conflicting requests for 12 available LOX carts stored at Sonem:

- 391st FS requested 6
- zzz FS requested 8
- qqq FS requested 4

After reviewing the requests and reasoning behind them, the WRMO approves 4 carts for each of the units. Of the 4 approved for the 391st, 2 are scheduled for maintenance before the 391st makes use of them. So 2 of the 391st's requests were denied, as well as 4 of the zzz's requests.

The items approved for the 391st won't be allocated until their MAJCOM WRMO (ACC/ LGXW) approves them as well. The MAJCOM WRMO for the zzz and the qqq has already approved their requests, so after being approved by USAFE/LGXW, they were allocated the items for use.

The system sent messages to the 391st, zzz, qqq and their MAJCOMs notifying them of the approvals and denials.

Narrative 11--System administrator updates data import schedule

The system administrator receives notice from the Sonem warehouse contractor that they will be providing data on a timelier basis: nightly updates instead of weekly updates. After signing into the WRM-CA system administration module, the administrator selects "Data Imports" from the schedule menu and the system displays a list of all regularly scheduled data import jobs. The administrator selects "Sonem maintenance data" from the list, and clicks "Edit." The system displays a dialog with various schedule options, with the current settings displayed. The administrator changes the frequency from weekly on Friday at 2000, to daily at 0300 and clicks update.

Narrative 12--Owning MAJCOM WRMO browsing WRM usage and movement for a specific plan

The owning MAJCOM WRMO from USAFE knows there are multiple requests for items stored in theater for the upcoming NATO exercise. From a popup menu, the WRMO selects "**Review Allocations**" and the system responds with the **Select Plan/Unit Line Number (ULN) screen**.

The WRMO selects the plan for the NATO exercise, and the system displays a list of ULNs within the plan. The WRMO does not select any ULN (wanting to see all of them), in the list of items to view checks "Allocated" and "Pending Allocation" (partially approved requests), and clicks "Open." The system then displays a summary of all items allocated to a ULN in the plan or with pending allocation. After sorting and summarizing the list in various ways, the WRMO selects "**View movement summary on map.**"

The system displays a "**Map summary options**" dialog showing a list of units deploying as part of the plan, WRM storage sites that have items allocated to the plan, and beddown locations that have units or WRM deploying into them. The WRMO checks "None" for "View deploying sites," "All" for "View WRM storage sites," and "All WRM employment sites" for "View Beddown Sites." For the "View transportation requirements," the WRMO checks "Lines," "Icons," and "Short tons by transport mode."

After clicking "OK," the system displays a site map zoomed out to fit all the selected sites. WRM storage sites are shown as a black triangle inside a white circle, beddown sites as green circles, (beddown sites employing WRM have a small black triangle as well). There are lines of different widths connecting WRM storage sites and beddown sites, the line width being larger for larger movement requirements. The site icons have small text boxes attached with the site name and total short tons of WRM being deployed from or to that particular site. For each mode of transport from the storage sites, there is an icon (airplane, ship, train, truck, question mark for unknown) with text showing the total short tons, and the first and last day (relative to C-Day) for

which WRM movement is scheduled to begin, and the first and last Required Delivery Date (RDD) for the WRM.

The WRMO notices the last RDD for truck shipments from Sonem to Aviano appears to be wrong, and double clicks on the truck icon for that line. The system then **displays a summary of transportation requirements** for WRM allocations and pending allocations for all truck shipments scheduled. At that level of detail, the WRMO can see that most of the equipment is being transported in a reasonable time frame, with a small amount of support equipment scheduled for a much later delivery. The WRMO then returns to the map.

APPENDIX B

Use Cases

WRM-CA Actor-Goal Use Case 1 -- Browse WRM Items		
Summary	Browse list of WRM item(s) or package(s) that meet user's requirement.	
Actors		
Author	dwSjoquist, 19 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "Browse WRM Items" (directly or as a step in another Use case).
	2	The user selects one or more WRM items.
	3	The system displays a summary list of all WRM items selected with a drill down to view individual WRM items.
Post-Conditions		
Exceptions and variations	2	If WRM items are already selected, then this step is skipped.

WRM-CA Actor-Goal Use Case 2 -- View WRM Information		
Summary	Display summary information for a particular item with options to display maintenance detail, movement information (part of a plan), or deployment history.	
Actors		
Author	dwSjoquist, 27 Dec 1999	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "View WRM information" (directly or as a step in another Use case).
	2	The user selects an item.
	3	The system displays summary information for the item with links to other information.
	Steps 4-10 are each optional, may occur in any order, and may occur multiple times.	
	4	The user views maintenance and inspection history.
	5	The user views item movement information.
	6	The user views deployment and reconstitution history.
	7	The user changes WRM information.
	8	The user requests the item.
	9	The user browses requests and allocations.
	10	The user requests notification of changes to this item.
Post-Conditions		
Exceptions and variations	2	If an item is already selected when beginning this Use case, this step is skipped.

WRM-CA Actor-Goal Use Case 5 -- Request WRM Item		
Summary	Request WRM item.	
Actors		
Author	dwSjoquist, 6 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "Request WRM Item" (directly or as a step in another Use case).
	2	The user selects a plan and ULN.
	3	The user selects an item.
	4	The user selects a priority for the request (low, medium, high).
	5	The user selects method to be notified when request is processed (e-mail, on login, etc.).
	6	The system stores the new request.
Post-Conditions	The request is recorded and all approvers have been notified.	
Exceptions and variations	2	If a plan and ULN are already opened, this step is skipped.
	3	If an item is already selected when beginning this Use case, this step is skipped.

WRM-CA Actor-Goal Use Case 7 -- Browse Requests and Allocations		
Summary	Browse through list of selected requests and allocations.	
Actors		
Author	dwSjoquist, 19 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "Browse Requests and Allocations" (directly or as a step in another Use case).
	2	The user selects one or more requests or allocations.
	3	The system displays a summary list of all requests and allocations selected with a drill down to view individual requests and allocations.
Post-Conditions		
Exceptions and variations	2	If requests or allocations are already selected, then this step is skipped.

WRM-CA Actor-Goal Use Case 8 -- View Request or Allocation		
Summary	Display a request for a single WRM item or a WRM package.	
Actors		
Author	dwSjoquist, 19 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "View Request or Allocation" (directly or as a step in another Use case).
	2	The user selects a request or allocation.
	3	The system displays summary information for the request, the various approvals required and decisions made, the status of the request and links to related information.
	Steps 4-9 are each optional, may occur in any order, and may occur multiple times as long the request exists (step 4 may cancel the request).	
	4	The user cancels or modifies the request.
	5	The user approves or denies the request.
	6	The user views WRM item information.
	7	The user views Plan/ULN information.
	8	The user views list of other requests and allocations for this item.
	9	The user requests notification of changes to this request.
Post-Conditions		
Exceptions and variations	2	If a request is already selected when beginning this Use case, this step is skipped.
	4	If the user is not the requesting user (or a user authorized to act on their behalf), then this option is not available.
	5	If the user is not in the list of approvers, then this option is not available.

WRM-CA Actor-Goal Use Case 16 -- View Plan/ULN		
Summary	Display a ULN from a WRM-CA notional plan.	
Actors		
Author	dwSjoquist, 19 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "View Plan/ULN" (directly or as a step in another Use case).
	2	The user selects a plan and ULN.
	3	The system displays summary information for the plan and the ULN and links to related information.
	Steps 4-8 are each optional, may occur in any order, and may occur multiple times	
	4	The user views Plan/ULN information for another ULN.
	5	The user browses requests and allocations for this ULN.
	6	The user browses requests and allocations for this Plan.
	7	The user views site information for one of the sites.
	8	The user requests notification of changes to this Plan or ULN.
Post-Conditions		
Exceptions and variations	2	If a Plan/ULN is already selected when beginning this Use case, this step is skipped.

WRM-CA Actor-Goal Use Case 17 -- View Site Information		
Summary	Display information about a specific site.	
Actors		
Author	dwSjoquist, 19 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "View Site Information" (directly or as a step in another Use case).
	2	The user selects a site.
	3	The system displays a summary list of all WRM items at the site with a drill down to view individual WRM items and links to related information.
	Steps 4-9 are each optional, may occur in any order, and may occur multiple times.	
	4	The user views Plan/ULN information.
	5	The user browses requests and allocations for current Plan/ULN associated with this site.
	6	The user views list of requests and allocations for any Plan/ULN for this site.
	7	The user views the WRM item.
	8	The user views the map highlighting this site.
	9	The user requests notification of changes to this site.
Post-Conditions		
Exceptions and variations	2	If a site is already selected when beginning this Use case, this step is skipped.
	4	If no plan is open, then no links to ULNs are shown.
	5	If no plan is open, then no links to site/plan related requests and allocations are shown.

WRM-CA Actor-Goal Use Case 19 -- View Site Inventory Information		
Summary	Browse list of WRM item(s) or package(s) at a specific site.	
Actors		
Author	dwSjoquist, 20 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A user has successfully signed into WRM-CA.	
Steps	1	The user selects "View Site Inventory information" (directly or as a step in another Use case).
	2	The user selects a site.
	3	The system displays a summary list of all WRM items at the site with a drill down to view individual WRM items.
Post-Conditions		
Exceptions and variations	2	If a site is already selected when beginning this Use case, this step is skipped.

WRM-CA Actor-Goal Use Case 101 -- Sign into WRM-CA		
Summary	A user must successfully sign into WRM-CA before anything else can happen. The sign-in process produces a user object which contains user profile information (roles, preferences, etc.) that is used in the rest of the system.	
Actors		
Author	dwSjoquist, 20 Jan 1999	
Owner		
Contacts		
Pre-Conditions		
Steps	1	This use case is triggered by other use cases, and immediately after client system initialization.
	2	The user enters a userid and password.
	3	The system verifies the validity of the userid and password.
	4	The system constructs a user profile object containing roles and preferences for the user.
	5	The system acknowledges the login.
Post-Conditions	User successfully logged in, and user object with profile information created and passed to client.	
Exceptions and variations		

WRM-CA Supporting Use Case 119 -- Store New Request		
Summary	When a request is made, it may require approval from multiple users before the item can be allocated. This use case determines who must approve a particular request, records the approvals needed, and notifies all users involved of the request.	
Actors		
Author	dwSjoquist, 7 Jan 2000	
Owner		
Contacts		
Pre-Conditions	A valid request object.	
Steps	1	Another use case triggers this use case.
	2	System builds a list of who must approve this request.
	Steps 3-4 are required for each approver.	
	3	System stores information for approval needed.
	4	System notifies approver or their proxy of pending request.
	5	System stores request information.
	6	System acknowledges user's request along with approvals required.
Post-Conditions	Request stored, approvers notified.	
Exceptions and variations	4,6	How the system notifies users is dependent on the type of notification and user preferences stored in the user profile.

WRM-CA Actor-Goal Use Case 124 -- Select WRM Item		
Summary	Find and select the WRM item(s) or package(s) that meet user's requirement.	
Actors		
Author	dwSjoquist, 27 Dec 1999	
Owner		
Contacts		
Pre-Conditions		
Steps	1	Another use case triggers this use case.
	2	The system prompts the user to enter selection criteria.
	Steps 3-8 may occur in any order and may occur multiple times. At least one of steps 3-7 must occur before step 8. Step 8 must occur at least once.	
	3	The user selects which sites to search.
	4	The user selects which NSNs or nomenclature to find.
	5	The user selects maintenance status to include.
	6	The user selects allocation status to include.
	7	The user selects plan and ULN again std which to check allocation status.
	8	The user selects "Search" and the system displays items current selection criteria.
	9	The user selects one or more items from the list.
Post-Conditions	One or more WRM items (by serial number) have been selected by the user.	
Exceptions and variations	8	If no matching items are found the use case may not proceed to step 9 (so the Use case fails if no further selections are attempted).

WRM-CA Supporting Use Case 125 -- Store Approval or Denial of Request			
Summary	For each approval required for a request, the approving user must make a decision of "approval" or "denial." A single denial from the list of approvals required makes the request status "denied." All required approvals must be "approved" to change the status to "approved" (which then triggers the actual allocation). If any required approvals are undecided (pending), then the request status is "pending."		
Actors			
Author	dwSjoquist, 20 Jan 2000		
Owner			
Contacts			
Pre-Conditions	A valid request object and a decision (approval or denial).		
Steps	1	Another use case triggers this use case.	
	2	System verifies the user profile matches the approver role assigned to this request.	
	3	System updates request information with decision (approval or denial).	
	4	System updates status of request.	
	5	System notifies requesting user, and other users who are listed as approvers of this request.	
Post-Conditions	Request updated, requestor and other approvers notified, allocation performed where appropriate.		
Exceptions and variations	4	Denial	The request status is changed to "denied."
		Approval	If any other required approval is "denied," the status is left as "denied."
			If any other required approval is "pending," the status is left as "pending."
			If all other required approvals are "approved," the status is changed to "approved" and the item is allocated.
	5	How the system notifies users is dependent on the type of notification and user preferences stored in the user profile.	

APPENDIX C

WRM-CA Data Tables

Database/Schema	Table used
EKB/Step	"Site"
	"AuditTrail"
	"WRMInventorySummary"
EKB/AAFIF	ARPT
	ARPT_COORD
Simulated LOGMOD	LF_FRC_CAP
	LF_INC
	LF_ITM

APPENDIX D

System Architecture